

TelePACE Ladder Logic

Warranty and License

CONTROL MICROSYSTEMS

SCADA products... for the distance

28 Steacie Drive
Kanata, Ontario
K2K 2A9
Canada

Telephone: 613-591-1943
Facsimile: 613-591-1022
Technical Support: 888-226-6876
888-2CONTROL

TelePACE Ladder Logic Warranty and License

©2000 - 2001 Control Microsystems Inc.
All rights reserved.

Printed in Canada.

Trademarks

TeleSAFE, TelePACE, SmartWIRE, SCADAPack, TeleSAFE Micro16 and TeleBUS are registered trademarks of Control Microsystems Inc.

All other product names are copyright and registered trademarks or trade names of their respective owners.

Material used in the User and Reference manual section titled SCADAServer OLE Automation Reference is distributed under license from the OPC Foundation.

Table of Contents

TABLE OF CONTENTS	2
TELEBUS DF1 PROTOCOL OVERVIEW.....	4
Compatibility.....	4
SERIAL PORT CONFIGURATION	5
Communication Parameters	5
Protocol Parameters	5
Baud Rate	6
Duplex.....	6
Protocol Parameters	7
Protocol Type	7
Station Number.....	7
Task Priority	7
Store and Forward Messaging	7
Default Parameters	7
I/O DATABASE.....	9
Coil and Status Registers	9
Input and Holding Registers.....	9
Accessing the I/O Database Using TelePACE	10
Modbus Addressing	10
DF1 Addressing	10
Converting Modbus to DF1 Addresses.....	11
Accessing the I/O Database Using ISaGRAF	12
Modbus Addressing	12
DF1 Addressing	12
Converting Modbus to DF1 Addresses.....	12
SLAVE MODE.....	14
Broadcast Messages	14
Function Codes	14
Protected Write	15
Unprotected Read.....	15
Protected Bit Write	15
Unprotected Bit Write.....	15
Unprotected Write.....	15
MASTER MODE	16
Function Codes	16
Protected Write	16

Unprotected Read.....	16
Protected Bit Write	17
Unprotected Bit Write.....	17
Unprotected Write.....	17
Sending Messages	17
Polling DF1 PLCs	18

TeleBUS DF1 Protocol Overview

TeleBUS communication protocols provide a standard communication interface to the controller. The protocols operate on a wide variety of serial data links. These include RS-232 serial ports, RS-485 serial ports, radios, leased line modems, and dial up modems. The protocols are generally independent of the communication parameters of the link, with a few exceptions.

TeleBUS protocol commands may be directed to a specific device, identified by its station number, or broadcast to all devices. Up to 255 devices may connect to one communication network.

The TeleBUS protocols provide full access to the I/O database in the controller. The I/O database contains user-assigned registers and general purpose registers. Assigned registers map directly to the I/O hardware or system parameter in the controller. General purpose registers can be used by ladder logic and C application programs to store processed information, and to receive information from a remote device.

Application programs can initiate communication with remote devices. A multiple port controller can be a data concentrator for remote devices, by polling remote devices on one port and responding as a slave on another port.

The protocol type, communication parameters and station address are configured separately for each serial port on a controller. One controller can appear as different stations on different communication networks. The port configuration can be set from an application program, from the TelePACE programming software, or from another Modbus or DF1 compatible device.

Compatibility

There are four TeleBUS DF1 protocols:

- The **TeleBUS DF1 Full-Duplex BCC** protocol is compatible with the DF1 Full-Duplex data link layer protocol with block check character (BCC) error checking.
- The **TeleBUS DF1 Full-Duplex CRC** protocol is compatible with the DF1 Full-Duplex data link layer protocol with 16-bit cyclic redundancy check (CRC-16) error checking.
- The **TeleBUS DF1 Half-Duplex BCC** protocol is compatible with the DF1 Half-Duplex data link layer protocol with block check character (BCC) error checking.
- The **TeleBUS DF1 Half-Duplex CRC** protocol is compatible with the DF1 Half-Duplex data link layer protocol with 16-bit cyclic redundancy check (CRC-16) error checking.

Compatibility refers to communication only. The protocol defines communication aspects such as commands, syntax, message framing, error handling and addressing. The controllers do not mimic the internal functioning of any programmable controller. Device specific functions – those that relate to the hardware or programming of a specific programmable controller – are not implemented.

Serial Port Configuration

Communication Parameters

The TeleBUS DF1 protocols are, in general, independent of the serial communication parameters. The baud rate and parity may be chosen to suit the host computer and the characteristics of the data link.

The port configuration can be set in four ways:

- using the TelePACE program;
- using the **set_port** function from a C application program;
- writing to the I/O database from a C or ladder logic application program; or
- writing to the I/O database remotely from a Modbus or DF1 compatible device.

To configure a serial port through the I/O database, add the module, CNFG Serial port settings, to the Register Assignment.

Protocol Parameters

The TeleBUS DF1 protocols are eight bit character-oriented protocols. The table below shows possible and recommended communication parameters.

Parameter	Possible Settings	Recommended Setting
Baud Rate	see <i>Baud Rate</i> section below	see <i>Baud Rate</i> section below
Data Bits	8 data bits	8 data bits
Parity	none even odd	none
Stop bits	1 stop bit 2 stop bits	1 stop bit
Flow control	disabled	disabled
Duplex	see <i>Duplex</i> section below	see <i>Duplex</i> section below

Baud Rate

The baud rate sets the communication speed. The possible settings are determined by the type of serial data link used. The table below shows the possible settings for the controller. Note that not all port types and baud rates are available on all controller ports.

Port Type	Possible Settings	Recommended Setting
RS-232 or RS-232 Dial-up modem	75 baud 110 baud 150 baud 300 baud 600 baud 1200 baud 2400 baud 4800 baud 9600 baud 19200 baud 38400 baud 57600 baud 115200 baud	Use the highest rate supported by all devices on the network.
RS-485	75 baud 110 baud 150 baud 300 baud 600 baud 1200 baud 2400 baud 4800 baud 9600 baud 19200 baud 38400 baud	Use the highest rate supported by all devices on the network.

Duplex

The TeleBUS DF1 protocols communicate in one direction at a time. However the duplex setting is determined by the type of serial data link used. The table below shows the possible settings for the controller. Note that not all port types are available on all controllers.

Port Type	Possible Settings	Recommended Setting
RS-232 or RS-232 Dial-up modem	half duplex full duplex	Use full duplex wherever possible. Use half duplex for most external modems.
RS-485	half duplex full duplex	Slave stations always use half duplex. Master stations can use full duplex only on 4 wire systems.

Protocol Parameters

The TeleBUS DF1 protocols operate independently on each serial port. Each port may set the protocol type, station number, protocol task priority and store-and-forward messaging options.

The protocol configuration can be set in four ways:

- using the TelePACE or ISaGRAF programs;
- using the **set_protocol** function from a C application program;
- writing to the I/O database from a C or ladder logic application program; or
- writing to the I/O database remotely from a Modbus or DF1 compatible device.

To configure protocol settings through the I/O database, add the module, CNFG Protocol settings, to the Register Assignment.

Protocol Type

The protocol type may be set to emulate the DF1 or Modbus protocols, or it may be disabled. When the protocol is disabled, the port functions as a normal serial port.

Station Number

The TeleBUS DF1 protocols allow up to 255 devices on a network. Station numbers identify each device. A device responds to commands addressed to it, or to commands broadcast to all stations.

The station number is in the range 0 to 254. Address 255 indicates a command broadcast to all stations, and cannot be used as a station number. Each serial port may have a unique station number.

Task Priority

A task is responsible for monitoring each serial port for messages. The real time operating system (RTOS) schedules the tasks with the application program tasks according to the task priority. The priority can be changed only with the **set_protocol** function from a C application program.

The default task priority is 3. Changing the priority is not recommended.

Store and Forward Messaging

Store and forward messaging is not supported by the TeleBUS DF1 protocols.

Default Parameters

All ports are configured at reset with default parameters when the controller is started in SERVICE mode. The ports use user-defined parameters when the controller is reset in the RUN mode. The default parameters are listed below.

Parameter	com1	com2	Com3	com4
Baud rate	9600	9600	9600	9600
Parity	none	none	None	none
Data bits	8	8	8	8

Parameter	com1	com2	Com3	com4
Stop bits	1	1	1	1
Duplex	full	full	Half	half
Protocol	Modbus RTU	Modbus RTU	Modbus RTU	Modbus RTU
Station	1	1	1	1
Rx flow control	none	none	Rx disable	Rx disable
Tx flow control	none	none	None	none
Serial time out	60 s	60 s	60 s	60 s
Type	RS-232	RS-232	RS-232	RS-232
Minimum Protected DF1 Address	0	0	0	0
Maximum Protected DF1 Address	11534	11534	11534	11534

Notes

com3 is supported only when the SCADAPack Lower I/O module is installed. com4 is supported only when the SCADAPack Upper I/O module is installed.

To optimize performance, minimize the length of messages on com3 and com4. Examples of recommended uses for com3 and com4 are for local operator display terminals, and for programming and diagnostics using the TelePACE program.

I/O Database

The TeleBUS protocols read and write information from the I/O database. The I/O database is an area of memory that can be accessed by C programs, Ladder Logic programs, ISaGRAF programs and communication protocols. The I/O database allows data to be shared between these programs. The I/O database contains user-assigned registers and general purpose registers.

User-assigned registers map directly to the I/O hardware or system parameter in the controller. Assigned registers are initialized to the default hardware state or system parameter when the controller is reset. Assigned output registers do not maintain their values during power failures. However, output registers do retain their values during application program loading.

General purpose registers are used by ladder logic, ISaGRAF and C application programs to store processed information, and to receive information from remote devices. General purpose registers retain their values during power failures and application program loading. The values change only when written by an application program or a communication protocol.

Coil and Status Registers

Coil and status registers contain one bit of information, that is whether a signal is off or on.

For TelePACE firmware coil registers are single bits which the protocols can read and write. There are 4096 coil registers located in the digital output section of the I/O database. Coil registers are contained within the DF1 16-bit addresses 0 to 255.

For TelePACE firmware status registers are single bits which the protocols can read. There are 4096 status registers located in the digital input section of the I/O database. Status registers are contained within the DF1 16-bit addresses 256 to 511.

For ISaGRAF firmware coil registers are single bits which the protocols can read and write. There are 9999 coil registers located in the digital output section of the I/O database. Coil registers are contained within the DF1 16-bit addresses 0 to 624.

For ISaGRAF firmware status registers are single bits which the protocols can read. There are 9999 status registers located in the digital input section of the I/O database. Status registers are contained within the DF1 16-bit addresses 625 to 1249.

Coil and status registers are accessed 16 at a time or individually (in some commands) using a bitmask. Writing a one to a bit within the 16-bit address turns the bit on. Writing zero to the bit turns the bit off. If the register is assigned to an I/O module, the bit status is written to the module output hardware or parameter.

Reading a coil or status register returns 1 if the bit is on, or 0 if the bit is off. The stored value is returned from general purpose registers. The I/O module point status is returned from assigned registers.

Input and Holding Registers

Input and holding registers contain 16-bit values.

Input registers are 16-bit registers which the protocol can read. For TelePACE firmware, there are 1024 input registers located in the analog input section of the I/O database. Input registers are contained within the DF1 addresses 512 to 1535.

For ISaGRAF firmware there are 9999 input registers located in the analog input section of the I/O database. Input registers are contained within the DF1 addresses 1250 to 11247.

Holding registers are 16-bit registers that the protocol can read and write. For TelePACE firmware there are 9999 holding registers located in the analog output section of the I/O database. Holding registers are contained within the DF1 addresses 1536 to 11534.

For ISaGRAF firmware there are 9999 holding registers located in the analog output section of the I/O database. Holding registers are contained within the DF1 addresses 11248 to 21247.

Writing any value to a general purpose register stores the value in the register. Writing a value to an assigned register, writes the value to the assigned I/O module.

Reading a general purpose register returns the value stored in the register. Reading an assigned register returns the value read from the I/O module.

Accessing the I/O Database Using TelePACE

Ladder logic programs access the I/O database through function blocks. All function blocks can access the I/O database. The function blocks in ladder logic use only the Modbus addressing scheme. Refer to the **TelePACE Ladder Logic Reference and User Manual** for details.

C language programs access the I/O database with two functions. The **dbase** function reads a value from the I/O database. The **setdbase** function writes a value to the I/O database. These functions use either Modbus or DF1 physical addressing. Refer to the **TelePACE C Tools Reference and User Manual** for full details on these functions.

Modbus Addressing

Modbus addressing is used in all ladder logic program functions. The controller's Register Assignment is also configured using Modbus addresses.

The C functions **dbase** and **setdbase** support Modbus addressing. When the specified port is configured for one of the Modbus protocols, the function **master_message** uses Modbus addressing.

Coil registers are single bit addresses ranging from 00001 to 04096.

Status registers are single bit addresses ranging from 10001 to 14096.

Input registers are 16-bit addresses in the range 30001 to 31024.

Holding registers are 16-bit addresses in the range 40001 to 49999.

DF1 Addressing

DF1 addressing is used by the **MSTR** ladder logic function when the specified port is configured for one of the DF1 protocols. Modbus addressing must be used in all other ladder logic program functions.

DF1 addressing is used by function **master_message** when the specified port is configured for one of the DF1 protocols. The functions **dbase**, **setdbase**, **setABConfiguration** and **getABConfiguration** also support DF1 addressing.

All DF1 addresses are absolute word addresses beginning with the first 16-bit register in the I/O database at address 0 and ending at address 11534.

Converting Modbus to DF1 Addresses

I/O database registers are assigned within the controller's Register Assignment using Modbus addressing. When polling the controller from an DF1 device it is necessary to know the DF1 address corresponding to each assigned register.

In general, the cross-reference between Modbus and DF1 addressing is shown in the following table. DF1 addresses in this table are described in the format **word/bit** where **word** is the address of a 16-bit word and **bit** is the bit within that word. The bit address is optional.

Address Range	Description
Modbus DF1 00001 to 04096 0/0 to 255/15	Digital Output Database (single bit registers)
Modbus DF1 10001 to 14096 256/0 to 511/15	Digital Input Database (single bit registers)
Modbus DF1 30001 to 31024 512 to 1535	Analog Input Database (16-bit registers)
Modbus DF1 40001 to 49999 1536 to 11534	Analog Output Database (16-bit registers)

Coil Registers

To convert a Modbus coil register, *ModbusCoil*, to an DF1 address word/bit:

$$\text{word} = (\text{ModbusCoil} - 00001) / 16$$

$$\text{bit} = \text{remainder of } \{ (\text{ModbusCoil} - 00001) / 16 \}$$

Status Registers

To convert a Modbus status register, *ModbusStatus*, to an DF1 address word/bit:

$$\text{word} = (\text{ModbusStatus} - 10001) / 16 + 256$$

$$\text{bit} = \text{remainder of } \{ (\text{ModbusStatus} - 10001) / 16 \}$$

Input Registers

To convert a Modbus input register, *ModbusInput*, to an DF1 address word:

$$\text{word} = (\text{ModbusInput} - 30001) + 512$$

Holding Registers

To convert a Modbus holding register, *ModbusHolding*, to an DF1 address word:

$$\text{word} = (\text{ModbusHolding} - 40001) + 1536$$

Example

In this example the equivalent DF1 addresses are shown next to a sample SCADAPack Register Assignment specified with Modbus addresses.

Module	Start Register	End Register	DF1 Address Range
SCADAPack Lower I/O module digital outputs digital inputs analog inputs	00001 10001 30001	00012 10016 30008	0/0 to 0/11 256/0 to 256/15 512 to 519

Module	Start Register	End Register	DF1 Address Range
DIN 5203/4 digital inputs	10017	10019	257/0 to 257/2
DIAG Force LED	10020	10020	257/3
SCADAPack AOUT module	40001	40002	1536 to 1537

Accessing the I/O Database Using ISaGRAF

ISaGRAF programs access the I/O database through function blocks. The function blocks in ISaGRAF may use the Modbus addressing scheme when a Network Address is defined for a variable. Refer to the *IEC 61131 User Manual* for details.

C language programs access the I/O database with two functions. The **dbase** function reads a value from the I/O database. The **setdbase** function writes a value to the I/O database. These functions use either Modbus or DF1 physical addressing. Refer to the *IEC 61131 User Manual* for full details on these functions.

Modbus Addressing

Modbus addressing can be used in ISaGRAF program functions. The controller's Register Assignment is also configured using Modbus addresses.

The C functions **dbase** and **setdbase** support Modbus addressing. When the specified port is configured for one of the Modbus protocols, the function **master_message** uses Modbus addressing.

Modbus addresses coil registers with a single bit address ranging from 00001 to 09999. Status registers are also addressed with single bit addresses ranging from 10001 to 19999. Input registers are addressed with 16-bit addresses in the range 30001 to 39999. And holding registers are addressed with a 16-bit address in the range 40001 to 49999.

DF1 Addressing

DF1 addressing is used by the **MSTR** ladder logic function when the specified port is configured for one of the DF1 protocols. Modbus addressing must be used in all other ladder logic program functions.

DF1 addressing is used by function **master_message** when the specified port is configured for one of the DF1 protocols. The functions **dbase**, **setdbase**, **setABConfiguration** and **getABConfiguration** also support DF1 addressing.

All DF1 addresses are absolute word addresses beginning with the first 16-bit register in the I/O database at address 0 and ending at address 21247.

Converting Modbus to DF1 Addresses

I/O database registers are assigned within the controller's Register Assignment using Modbus addressing. When polling the controller from an DF1 device it is necessary to know the DF1 address corresponding to each assigned register.

In general, the cross-reference between Modbus and DF1 addressing is shown in the following table. DF1 addresses in this table are described in the format **word/bit** where **word** is the address of a 16-bit word and **bit** is the bit within that word. The bit address is optional.

Address Range		Description
Modbus DF1	00001 to 04096 0/0 to 624/15	Digital Output Database (single bit registers)
Modbus DF1	10001 to 14096 625/0 to 1249/15	Digital Input Database (single bit registers)
Modbus DF1	30001 to 31024 1250 to 11248	Analog Input Database (16-bit registers)
Modbus DF1	40001 to 49999 11249 to 21247	Analog Output Database (16-bit registers)

Coil Registers

To convert a Modbus coil register, *ModbusCoil*, to an DF1 address word/bit:

$$\text{word} = (\text{ModbusCoil} - 00001) / 16$$

$$\text{bit} = \text{remainder of } \{ (\text{ModbusCoil} - 00001) / 16 \}$$

Status Registers

To convert a Modbus status register, *ModbusStatus*, to an DF1 address word/bit:

$$\text{word} = (\text{ModbusStatus} - 10001) / 16 + 625$$

$$\text{bit} = \text{remainder of } \{ (\text{ModbusStatus} - 10001) / 16 \}$$

Input Registers

To convert a Modbus input register, *ModbusInput*, to an DF1 address word:

$$\text{word} = (\text{ModbusInput} - 30001) + 1250$$

Holding Registers

To convert a Modbus holding register, *ModbusHolding*, to an DF1 address word:

$$\text{word} = (\text{ModbusHolding} - 40001) + 11249$$

Example

In this example the equivalent DF1 addresses are shown next to a sample SCADAPack Register Assignment specified with Modbus addresses.

Module	Start Register	End Register	DF1 Address Range
SCADAPack Lower I/O module digital outputs digital inputs analog inputs	00001 10001 30001	00012 10016 30008	0/0 to 0/11 625/0 to 625/15 1250 to 1257
DIN 5203/4 digital inputs	10017	10019	626/0 to 626/2
DIAG Force LED	10020	10020	626/3
SCADAPack AOUT module	40001	40002	11249 to 111250

Slave Mode

The TeleBUS DF1 protocols operate in slave and master modes simultaneously. In slave mode the controller responds to commands sent by another device. Commands may be sent to a specific device or broadcast to all devices.

The TeleBUS DF1 protocols emulate the protocol functions required for communication with a host device which uses the Non-Privileged commands from the DF1 Basic Command Set. These functions are described below.

Consult the DF1 I/O driver documentation included with the SCADA package, or specific DF1 documentation, for details on these commands. In most cases a knowledge of the actual commands is not required to set up the host system.

Broadcast Messages

A broadcast message is sent to all devices on a network. Each device executes the command. No device responds to a broadcast command. The device sending the command must query each device to determine if the command was received and processed. Broadcast messages are supported for function codes that write information.

A broadcast message is sent to station number 255.

Function Codes

The table summarizes the implemented function codes. Note that slave commands at the protocol layer access the I/O database in physical byte addresses. However, in master mode the interface to the TeleBUS DF1 protocol accesses the I/O database in physical 16-bit word addresses. The interface function block **MSTR** and C function **master_message** are described in the *Master Mode* section below.

The maximum number of 16-bit words that can be read or written with one slave command message is shown in the maximum column.

Function	Name	Description	Maximum
00	Protected Write	Writes words of data to limited areas of the database.	121
01	Unprotected Read	Reads words of data from any area of the database.	122
02	Protected Bit Write	Sets or resets individual bits within limited areas of the database.	30
05	Unprotected Bit Write	Sets or resets individual bits in any area of the database.	30
08	Unprotected Write	Writes words of data to any area of the database.	121

Functions 0, 2, 5 and 8 support broadcast messages. The functions are described in detail below.

Protected Write

The Protected Write function writes 8 bit values into limited areas of the I/O database. Access to the I/O database is limited to the protected address range.

Any number of bytes may be written up to the maximum number. The write may start at any byte address, provided the entire block is within the protected address range.

The protected address range is set using the **setABConfiguration** function from a C application program.

Unprotected Read

The Unprotected Read function reads 8 bit values from any area of the I/O database. Access to the I/O database is limited to the unprotected address range.

Any number of bytes may be read up to the maximum number. The read may start at any byte address, provided the entire block is within the unprotected address range.

Protected Bit Write

The Protected Bit Write function sets or resets individual bits within limited areas of the I/O database. Access to the I/O database is limited to the protected address range.

Bits are accessed one byte at a time and may be written up to the maximum number of bytes. The write may start at any byte address, provided the entire block is within the protected address range.

Unprotected Bit Write

The Unprotected Bit Write function sets or resets individual bits in any area of the I/O database. Access to the I/O database is limited to the unprotected address range.

Bits are accessed one byte at a time and may be written up to the maximum number of bytes. The write may start at any byte address, provided the entire block is within the unprotected address range.

Unprotected Write

The Unprotected Write function writes 8 bit values into any area of the I/O database. Access to the I/O database is limited to the unprotected address range.

Any number of bytes may be written up to the maximum number. The write may start at any byte address, provided the entire block is within the unprotected address range.

Master Mode

The TeleBUS DF1 protocols may act as a communication master on any serial port. In master mode, the controller sends commands to other devices on the network. Simultaneous master messages may be active on all ports.

Function Codes

The table shows the implemented function codes. Note that slave commands at the protocol layer access the I/O database in physical byte addresses. However, in master mode the interface to the TeleBUS DF1 protocol accesses the I/O database in physical 16-bit word registers. The interface function block **MSTR** and C function **master_message** are described in the *Sending Messages* section below.

The maximum number of 16-bit registers that can be read or written with one message is shown in the maximum column. The slave device may support fewer registers than shown; consult the manual for the device for details.

Function	Name	Description	Maximum
00	Protected Write	Writes words of data to limited areas of the database.	121
01	Unprotected Read	Reads words of data from any area of the database.	122
02	Protected Bit Write	Sets or resets individual bits within limited areas of the database.	1
05	Unprotected Bit Write	Sets or resets individual bits in any area of the database.	1
08	Unprotected Write	Writes words of data to any area of the database.	121

Protected Write

The Protected Write function writes 16-bit values into the I/O database of the slave device. Access to the I/O database is limited to the protected address range of the slave device. The data may come from any area of the master I/O database within its unprotected address range.

Any number of 16-bit registers may be written up to the maximum number supported by the slave device or the maximum number above, which ever is less. The write may start at any 16-bit register, provided the entire block is within the protected address range of the slave device.

Unprotected Read

The Unprotected Read function reads 16-bit values from any area of the I/O database of the slave device. Access to the I/O database is limited to the unprotected address range of the slave device. Data can be written into any area of the master I/O database within its unprotected address range.

Any number of 16-bit registers may be read up to the maximum number supported by the slave device or the maximum number above, which ever is less. The read may start at any

16-bit register, provided the entire block is within the unprotected address range of the slave device.

Protected Bit Write

The Protected Bit Write function sets or resets individual bits in the I/O database of the slave device. Access to the I/O database is limited to the protected address range of the slave device. The data may come from any area of the master I/O database within the unprotected address range.

One 16-bit register with a bitmask is used to write up to 16 bits of data. The register must be within the protected address range of the slave device.

Unprotected Bit Write

The Unprotected Bit Write function sets or resets individual bits in any area of the I/O database of the slave device. Access to the I/O database is limited to the unprotected address range of the slave device. The data may come from any area of the master I/O database within its unprotected address range.

One 16-bit register with a bitmask is used to write up to 16 bits of data. The register must be within the unprotected address range of the slave device.

Unprotected Write

The Unprotected Write function writes 16-bit values into any area of the I/O database of the slave device. Access to the I/O database is limited to the unprotected address range of the slave device. The data may come from any area of the master I/O database within its unprotected address range.

Any number of 16-bit registers may be written up to the maximum number supported by the slave device or the maximum number above, which ever is less. The write may start at any 16-bit register, provided the entire block is within the unprotected address range of the slave device.

Sending Messages

A master message is initiated in two ways:

- using the **master_message** function from a C application program; or
- using the **MSTR** function block from a ladder logic program.

These functions specify the port on which to issue the command, the function code, the slave station number, and the location and size of the data in the slave and master devices. The protocol driver, independent of the application program, receives the response to the command.

The application program detects the completion of the transaction by:

- calling the **get_protocol_status** function in a C application program; or
- using the output of the **MSTR** function block in a ladder logic program.

A communication error has occurred if the slave does not respond within the expected maximum time for the complete command and response. The application program is responsible for detecting this condition. When errors occur, it is recommended that the application program retry several times before indicating a communication failure.

The completion time depends on the length of the message, the length of the response, the number of transmitted bits per character, the transmission baud rate, and the maximum message turn-around time. One to three seconds is usually sufficient. Radio systems may require longer delays.

Polling DF1 PLCs

All DF1 PLCs, except the PLC-5/VME, will support some portion of the basic commands implemented.

AB PLC	Unprotected Read	Unprotected Write	Protected Write	Protected Bit Write	Unprotected Bit Write
MicroLogix ⁴ 1000	✓	✓			
SLC500 ^{1,3}	✓	✓			
SLC5/01 ^{1,3}	✓	✓			
SLC5/02 ^{1,2,3}	✓	✓			
SLC5/03 ^{2,3}	✓	✓			
SLC5/04 ^{2,3}	✓	✓			
1774-PLC	✓	✓	✓	✓	✓
PLC-2	✓	✓	✓	✓	✓
PLC-3 ⁵	✓	✓	✓	✓	✓
PLC-5 ⁵	✓	✓	✓	✓	✓
PLC-5/250 ⁵	✓	✓		✓	✓
PLC-5/VME					

Notes

¹ At the protocol level these commands convert and send the slave word address as a byte address. The SLC500, 5/01 (and 5/02, prior to Series C FRN 3) treat this byte address as if it were a word address in the SLC500. This means that the (desired word address)/2 must be specified for the Slave Register Address in MSTR or master_message. Note that this always results in an even starting word address in the slave SLC. (E.g. Slave word address of 7 specified in MSTR accesses SLC word address 14.)

² The SLC5/02, 5/03 and 5/04 have a status selection bit (S:2/8) which allows selection of either word or byte addressing when interpreting only these commands. (Setting SLC bit S:2/8 = 1 selects byte addressing so that, for example, a slave word address of 7 specified in MSTR accesses SLC word address 7.)

³ These commands can access SLC memory only in the CIF or Common Interface File: N9. See further details in section 12-15 of the SLC500 Instruction Set manual.

⁴ These commands can access MicroLogix memory only in the CIF or Common Interface File: N7. See further details in section 12-15 of the MicroLogix 1000 Instruction Set manual.

⁵ These commands can access memory only in the CIF or “PLC-2 compatibility file”: N7. See further details in section 16-7 of the PLC-5 manual.